Chapter 221

Development of phytocosmetics based on the hydroalcoholic extract of Myrciaria cauliflora (jabuticaba)

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ABSTRACT
Brazil holds the largest reserves of natural resources in the world, being an international highlight in biological diversity, it is estimated that 20% of the total species already inventoried are in Brazil. However, the literature indicates that there are few studies related to the use and development of technologies from native plants, mainly in the cosmetic industry. This work aims to develop a cosmetic product based on the hydroalcoholic extract of the bark of *Myrciaria Cauliflora* (jabuticaba) and carry out its quality control. As an extraction methodology, cold maceration was used, with distilled water as the extracting liquid. Three different concentrations of extract incorporation were tested [1.5%], [3.5%] and [4.0%], in triplicate, and centrifugation tests, temperature stress, organoleptic assays, pH, density, and spreadability. All samples were stable in most tests, with changes being observed in centrifugation tests (creaming) in all samples, and temperature stress at 70°C, where there was flocculation of concentration samples [4.0%]. The moisturizer obtained from the hydroalcoholic extract of *Myrciaria cauliflora* bark has a potential cosmetological profile, being an economical alternative for the cosmetic industries due to the possible reuse of waste from the food industry, and encompasses the new market of consumers who value the ecological footprint of companies.

Keywords: Anthocyanins, Cosmetics, Myrciaria cauliflora.

1 INTRODUCTION

Brazil has international prominence in issues of biodiversity in fauna and flora and holds the largest reserves of natural resources in the world, within its tropical biomes. It is estimated that 20% of the total species already inventoried are in Brazil, giving an unthinkable value to Brazilian natural heritage. Thus, there is great potential for research and the use of these resources for the benefit of human health. The search for a standard of beauty, especially among women, has encouraged the cosmetic industry to research and discover new formulations to improve the appearance of the skin and slow aging. With this in mind, the use of Brazilian bioactive has grown exponentially over the years, with records of a growth of 10% in the period between 2010 and 2011 (HENRIQUE; LOPES, 2017).

Many sources of natural antioxidants are currently known and found in Brazilian biomes; plant extracts such as rosemary, marjoram, and oregano, and fruit extracts such as grapes and strawberries have been studied due to their antioxidant potential due to the phenolic compounds present (FERNANDES, 2019).

The incentive to study native plants adds knowledge about these species and motivates new economic activities in the Brazilian market, which can benefit the search for the rational use of residues from industrial food processes, such as inedible parts of the fruits, causing numerous benefits for the environment and for humanity, which will restrict food waste and favor the development of economically striking behaviors. Within this plant diversity native to Brazil, we can highlight the fruits of the *Myrtaceae family*. This family has ecological importance, being distributed mostly as edible species, have bee characteristics, and is widely used in traditional medicine (MEIRA et al., 2016).

One can highlight the fruit species *Myrciaria cauliflora*, popularly known as jabuticabeira. A tree of spontaneous occurrence in much of Brazil, its fruit, the jabuticaba, does not have a very high commercial value, because it is very perishable. Although the production of a single foot is so large and is considered suitable for consumption in *natur*e and also for use in industry, after harvesting, the fruit has a shelf life of up to three days, which reduces the probability of its commercialization (CRUZ, 2014).

Emulsions are one of the oldest forms of cosmetic application. The Greek physicist Galen (150 d. C.) is considered the creator of the first emulsion called "*cold cream*". Although it is an instability of the final product, this was an important step in the development of emulsions (FIDELIS, 2020).

The emulsions stand out in the market as the best pharmaceutical form and the most attractive to the consumer. They are widely used in cosmetic and pharmacological products and may have numerous advantages, such as good visual appearance, being pleasant to the touch and human eye, and the possibility of carrying out the transmission of hydrophilic and lipophilic actives in the same formulation, in addition to facilitating sensory control, meeting the needs of the route of administration. The pleasant sensation that is promoted by the use of the emulsion is of paramount importance for consumer acceptance (CASTRO, 2014).

Thus, this work aims to develop an emulsified cosmetic pharmaceutical form containing a hydroalcoholic extract of jabuticaba.

2 LITERATURE REVIEW

The jabuticabeira is a tree of the *Myrtaceae* family that has flowers and is found in a wide geographical range in Brazil, from Rio Grande do Sul to Pará. The regions that produce the largest amount of jabuticabas are São Paulo, Rio de Janeiro, Minas Gerais, and Espírito Santo. There are several species of jabuticabeiras, especially Myrciaria cauliflora (DC) Berg, known as jabuticaba paulista, and *Myrciaria* jabuticaba (Vell) *Berg*, called jabuticaba Sabará (ALVES. et al., 2021).

Myrciaria cauliflora is a fruit species popularly known as "jabuticabeira", "jabuticaba", "jabuticaba paulista", "jabuticabaaçu", "jabuticaba-do-mato" and "jabuticaba-sabará". This plant is highly valued by rural producers due to its high productivity, rusticity, and the possibility of using the fruits in different food products, such as jellies, liqueurs, juices, ice cream, jams, and kinds of vinegar (WU, S.-B.; LONG; Kennelly, 2013).

The polyphenolic compounds present in *Myrciaria cauliflora* are responsible for their biological properties. In addition to anthocyanins and aglycones, such as cyanidin, this species has tannins, isoquercitrin, myricetin, and ellagic acid. Other antioxidant substances, such as ascorbic acid, are also found in this plant (BORGES; CONCEPTION; SILVEIRA, 2013).

Several biological activities are attributed to jabuticaba, including antioxidant, antitumor, anti-inflammatory, antiviral, and in the treatment of digestive problems and hypertension. The potential of industrial applications of jabuticaba has aroused commercial interest (PACHECO, 2015).

Its fruits are globose and can reach up to 3 cm in diameter, have a thin bark of reddish-purple color and astringent flavor. The pulp is sweet, whitish, mucilage nic, translucent and contains one to four seeds. Jabuticaba is rich in anthocyanins and flavonoids and is popularly used in decocto to treat diarrhea and skin irritations. (LAGE, 2014; ANDRADE et al., 2015).

Jabuticaba has a high nutritional value, with significant levels of fiber (2.3g/100g), potassium (130mg/100g) and magnesium (18mg/100g). The peels and seeds of the fruit, often discarded, represent about 50% of the total (ALVES et.al., 2021).

Jabuticaba bark extracts contain bioactive compounds such as anthocyanins, phenolic compounds, and tannins, in concentrations ranging from 367 to 1,420 mg 100 g-1 of anthocyanins and 196 to 571 mg 100 $^{g-1}$ of flavonoids. Studies show that these compounds can provide health benefits, contributing to control of inflammation, lipid and glycemic profile, oxidative stress and free radicals (ABREU, FERREIRA, 2013; MIRANDA, 2019).

Jabuticaba is a highly perishable fruit due to its high water and sugar content. If stored at room temperature, its shelf life is short, lasting only 2 to 3 days before it begins to ferment, deteriorate and lose moisture. To prolong its commercialization, it is necessary to use post-harvest technologies such as refrigeration and modified atmosphere. Depending on the purpose, drying can be used as a conservation method to make the fruit stable to chemical and microbial deterioration, increasing its commercial value (BARBOSA, 2014; NUNES et.al., 2014; MORGADO et. al., 2019).

Drying fruits has several benefits, such as increasing the shelf life of food, preserving nutrients and preventing the proliferation of microorganisms, which helps maintain the flavor for longer. In addition to being used for food preservation, drying is also employed in the production of products such as pasta, cookies, flours, yogurts, creams and ice cream (GURAK, et al., 2014; MACHADO, 2015; SILVA et al., 2020).

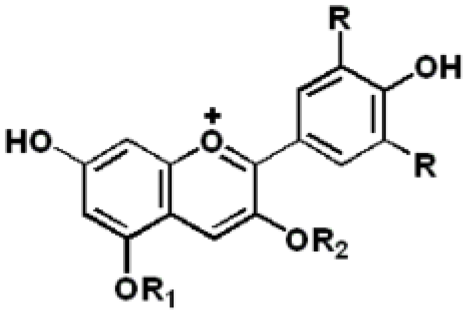
During the industrialization process of jabuticaba, much of the fruit is discarded, representing about 30% to 43% of the total, generating a large amount of waste. Although some of this material is used as animal feed, most of it is discarded or used in composting. However, these wastes contain a variety of valuable and useful substances that could be harnessed more efficiently, increasing their commercial value and avoiding environmental problems arising from disposal in the soil. For example, jabuticaba peels contain natural dyes that can be used by the food, pharmaceutical and cosmetic industries, as well as serving as raw material for the extraction of phytopharmaceuticals and other standardized extracts. Despite the great potential of these wastes, there are still few studies that investigate their effective use (BORGES, 2014).

In the economic sphere, the food and cosmetic industries are the ones that invest the most in research of national fruits. The commercial proposal of organic and natural products has gained prominence in countries such as Brazil, which are rich in biodiversity. Tropical fruits are known for their high concentration of compounds with physical, chemical and pharmacological properties, which are of interest in several sectors, contributing to the prevention of diseases and prolonging life. The jabuticaba is also an example of a tropical fruit with these characteristics (MOREIRA; SEVERIANO, 2021).

Phenolic compounds are secondary metabolites found in various parts of plants, such as fruits, seeds, tree bark, roots, and flowers. Its antioxidant activity occurs by donating electrons or hydrogen atoms to free radicals, in addition to acting as metal chelators, inhibiting the formation of free radicals catalyzed by transition metals. Flavonoids are one of the main groups of phenolic compounds and are present in many plant tissues. They are plant pigments that give color to leaves, flowers and fruits, and have defense functions, such as protection against UV radiation. Anthocyanins are a subclassification of flavonoids and have functions such as insect attraction, photoprotection, modulation of photoinhibition, potentiation of photosynthesis and act as endogenous antioxidants, the latter being considered its most important property (BOMBANA, 2019; LAGE, 2014).

Anthocyanin is composed of a basic polycyclic chain, which contains three aromatic rings and a total of fifteen carbons. The structure of anthocyanin also has ester bonds between organic acids and sugars. The diversity of anthocyanins in the plant kingdom is originated from different radicals linked to its structure, which varies between families, genera and species of plants (MOREIRA and SEVERIANO, 2021).

Figure 1. The basic structure of anthocyanin



Source: Lopes (2007)

Anthocyanin is a pigment responsible for several colors in the plant kingdom, such as blue, violet, purple, magenta, and orange. It is found in fruits such as apple, blackberry, jabuticaba, jambolão and açaí. Studies show that consuming anthocyanin-rich foods can help reduce obesity, prevent certain cancers and cardiovascular diseases, and improve the immune system. Anthocyanins also have antioxidant, anti-inflammatory, antiviral, and antitumor properties, which makes them important for the pharmaceutical industry. (MOREIRA and SEVERIANO, 2021).

Emulsions are pharmaceutical forms used in cosmetics consisting of two immiscible liquids: a dispersed internal phase and a dispersing outer phase. To stabilize this system, you must add an emulsifying agent. Emulsions are thermodynamically unstable, which means that stabilization is crucial to product quality and effectiveness (CASTRO, 2014; ROSÁRIO et.al, 2021).

Emulsions are composed of two immiscible phases: an aqueous phase and an oily phase. The ratio between these phases determines the type of emulsion that will be formed. The emulsions must be stable and have a predefined period of physicochemical stability so that they can be applied in different areas, such as cosmetics, pharmaceutical and chemistry in general. To ensure the stability of emulsions, it is necessary to control several factors, such as the selection of ingredients and the manufacturing process (FIDELIS, 2020; MAGALHÃES, 2013).

3 METHODOLOGICAL PROCEDURE

For the execution of the work, a review of the literature on the development of an antioxidant cosmetic product based on jabuticaba extract was carried out. The selection of research sources was based on publications found in the databases: Google Scholar, Lilacs, Scielo Virtual Library and PubMed. In addition to books, monographs, dissertations and theses. For the search in the databases, the following descriptors were used both in Portuguese and in English: anthocyanins; cosmetics; *Myrciaria Cauliflora*. Inclusion criteria were considered for choosing articles published from 2013 to the current year. After reading the abstracts, 13 articles were selected that supported the discussion of this work.

The selection of ingredients used in the emulsions was based on market trends in the Brazilian cosmetic sector. According to studies, there is an increase in demand for products that contain natural activities, in response to social and economic changes that emphasize the importance of preserving the environment. These products can be classified as organic, natural or biocosmetic (ISAAC, 2016).

3.1 PREPARATION OF THE EXTRACT

The method used was that of extraction by maceration, which consists of a physical operation, based on the friction of the plant drug (bark of *Myrciaria Cauliflora*) in contact with an extracting liquid, and therefore, a filtrate of this solution is performed. It is a method of cold extraction, and the solvent was chosen water, which is widely used in the production of cosmetics because it has a pH that does not harm the skin, and because it does not degrade anthocyanin molecules.

3.2 CHOICE AND ACQUISITION OF RAW MATERIAL

Samples of jabuticabas were collected from private property in the city of Itapoã, DF, in February 2023. Before being used, the samples were properly sanitized in running water, and both the bark and pulp were separated manually. A total of 1 kg of sample was collected, but only 100g were used and stored in a freezer after the manual separation process.

3.3 PREPARATION OF THE BASIC FORMULATION

The cream base was formulated in the pharmacotechnical Laboratory of UNICEPLAC and the corresponding components, functions, and concentrations can be found in Chart 1. To begin with, each raw material was weighed separately: self-emulsifying wax (Lanette N), liquid petroleum jelly, isopropyl myristate, BHT, propylparaben, methylparaben, propylene glycol, sodium EDTA and water q.s.p 300mL. Then, the aqueous and oily phases were prepared in separate containers, adding the components of each phase in a 100mL beaker and dissolving them. The oil phase and the aqueous phase were heated separately to 75-80°C. After heating, the oil phase was added over the aqueous phase under agitation until the temperature of the mixture reached room temperature (25-30°C). Finally, the hydroalcoholic extract of the bark of *Myrciaria cauliflora* was added and the mixture was homogenized.

The entire process of formulation and manipulation of the product followed the good practices of handling and control defined in the Resolutions of the Collegiate Board (RDC) 67/2007 and (RDC) 87/2008 of the National Health Surveillance Agency (ANVISA).

3.4 INCORPORATION OF THE HYDROALCOHOLIC EXTRACT OF THE BARK OF *MYRCIARIA CAULIFLORA*

Initially, the base formulation was divided into nine containers containing 30g in each. Then, the hydroalcoholic extract of the bark of *Myrciaria Cauliflora* (jabuticaba) was incorporated into the formulation in different concentrations: 1.5% in containers (1), (2), and (3); 3.5% in containers (4), (5) and (6); and 4.0% in containers (7), (8) and (9). For the preparation of the extract, 2g of *Myrciaria Cauliflora* bark was used.

Subsequently, each concentration was visually analyzed to verify possible changes in viscosity, coloration, phase separation, or sedimentation. The concentration that was best incorporated into the formulation was chosen to perform the other tests.

3.5 TECHNOLOGICAL ANALYSIS OF COSMETICS

In this work, quality control analyses were performed in an antioxidant moisturizer, considering organoleptic and physicochemical characteristics. The evaluation was made qualitatively and quantitatively. The physicochemical parameters evaluated depend on the components used in the formulation and must comply with the legislation of the country in which the product will be marketed. It is important that the pH of the cosmetic is between 4.5 and 6.5 to be compatible with the pH of human skin and avoid irritation. The antioxidant moisturizer produced is classified as Grade 1 by ANVISA, intended only for cosmetic use.

No tests were performed to evaluate the antioxidant activity of the product since the objective of the work was the development and quality control of the formulation. The methodology used was based on references from the scientific literature of authors Silva et al, 2019.

Centrifugation test

Centrifugation increases the mobility of particles and anticipates possible instabilities, which can be observed in the form of precipitation, phase separation, compact sediment formation or coalescence. To perform the test, 5 g of sample was used in triplicate and centrifuged at 300rpm for 30 min at room temperature. Then, a visual evaluation was performed for macroscopic analysis of instability (BRASIL, 2023).

Temperature Stress Test

The sample was subjected to extreme temperature conditions to evaluate its thermal stability. 5 g of the sample were weighed and heated in a water bath at 40, 50, 60, and 70 °C, keeping each temperature for 30 minutes. Next, visual analysis was performed to verify possible instabilities in the sample. The methodology used in this test is based on references from the scientific literature. (SILVA, 2019).

Assessment of formulation stability

The sample was submitted to environmental conditions of temperatures to simulate domestic storage, in a period of 0 to 15 days, where they were evaluated at 0 and 30 days after production (BRASIL, 2023).

Organoleptic Tests

The parameters were evaluated at 0 and 15 days after production and storage at room temperature, to verify possible changes in the formulation. This methodology follows the guidelines established by ANVISA in its regulation of quality control of cosmetic products (ANVISA, 2004).

Aspect

Visual analysis was performed to evaluate whether the sample maintained the same macroscopic characteristics observed at time 0 or if changes occurred, such as phase separation, precipitation, and clouding, among others. This methodology follows the guidelines established by ANVISA in its regulation of quality control of cosmetic products (ANVISA, 2017).

Color

The comparison of the color of the sample was performed visually under white natural light, in comparison to the data obtained at time 0. This methodology follows the guidelines established by ANVISA in its regulation of quality control of cosmetic products (ANVISA, 2017).

Odour

To evaluate possible changes in the odor of the sample, a direct comparison between the initial and final odor was performed using smell. This methodology follows the guidelines established by ANVISA in its regulation of quality control of cosmetic products (ANVISA, 2017).

Physico-chemical tests

Technical analysis operations were performed to determine one or more characteristics of the product, following a specified procedure. This methodology is under the guidelines established by ANVISA for the quality control of cosmetic products (ANVISA, 2004).

ph

The pH analysis of the formulation was performed by diluting 1g of the sample in 10 mL of distilled water and measuring the pH of the resulting solution with the aid of a pH meter (ANVISA, 2004).

Density

Measurements of the apparent density of the sample were performed, for this, a quantity of the sample was weighted and introduced into a beaker to measure the volume and, subsequently, obtain the value of the apparent density by the formula:

$$\text{Calculation: } D = m/v$$

Where: D = apparent density in g/cm 3, m = mass of the sample in g, v = final volume in cm^3 (ANVISA, 2017).

Spreadability Test

The spreadability of the sample was determined by placing 0.35g between two glass plates on a millimeter of paper. Every 3 minutes, weights of 100, 200, and 300g were added to the upper plate and the scatter ability diameters were read. The values obtained were used to calculate spreadability (BRASIL, 2023).

Calculation of spreadability:

$$Ei = d^2 * \frac{\pi}{4}$$

Where: Ei = sample spreadability for a given weight I (mm 2); d^2 = average diameter (mm).

Statistical Analysis

Statistical analyses of the data obtained during the tests were performed, using statistical resources, graphs, and tables, similar to Microsoft Office Excel and Word software.

4 PRESENTATION AND ANALYSIS OF DATA

Table 1 was developed to present the components of the formulation of the base cream, as well as their due proportions and cosmetological functions.

Table 1. Formulation of the cream base

Components	Weight	Cosmetological function
Lanette N	30%	Emulsifier
Liquid Vaseline	3,90%	Emollient
Isopropyl myristate	7,50%	Emollient
BHT	0,30%	Antioxidant
Nipazol	0,15%	Preservative
Nipagin	0,45%	Preservative
Propylene glycol	30%	Wetting
Na2 EDTA	0,75%	Chelation
Distilled water	Q.s.p 300 g	Vehicle

Source: Author Himself (2023).

Table 2 was developed to present the theoretical results of this work. It was based on guidelines contained in Katz's scientific writing book (2009).

Table 2 - Table based on Katz (2009) containing: reference/source of scientific articles, and their most relevant results.

Reference	Findings
BORGES; 2014	The dry extract of *Myrciaria cauliflora* bark standardized in ellagic acid has been shown to have desirable characteristics for active inputs useful in the food, pharmaceutical, and cosmetic industries.
ABREU and FERREIRA; 2013	The reviewed studies presented efficient methods of extraction and concentration of anthocyanin bioactive compounds, however, the development of science and technology should always be encouraged, to obtain more efficient methods that lead the general population benefits and safety when consuming products with special purposes.
PACHECO; 2015	The physicochemical characteristics and antioxidant activities, the similarity of the inhibitory capacity on glucosidases was distinct among the different fruits analyzed, although belonging to the same botanical family *(Myrtaceae*).
HENRY; LOPES; 2017	The study reinforced the importance of antioxidants in the fight against skin aging, and corroborated the use of polyphenols, especially flavonoids, as actives by the cosmetics industry. Through the analysis, it was possible to evaluate the growing use of biodiversity for the development of new cosmetic activities.
SOUZA; 2013	The total phenolic contents, flavonoids and antioxidant activity were the response variables for central composite planning. The models developed by all responses showed a significant regression and non-significant lack of adjustment for a confidence level of 95%.
GOMES, 2020	The study characterized the main phenolic constituents of the shell, pulp and seed, and their bioactive potential. The seeds of the grape were mainly characterized as flavonols, while the skins were characterized by derivatives of hydroxycinnamic and hydroxybenzoic acids. The seed presented a higher phenolic concentration than the bark and pulp.
HENTZ; 2013	The results obtained allowed us to maximize the extractive processes of anthocyanins and define their operating conditions. The solvents ethanol and methanol, in freeze-dried plant material, proved to be more efficient for the extraction of total anthocyanins. In the extracts, delphinidin-3-glycoside, cyanidin-3-glycoside, and peonidin-3-glycoside were characterized with probable anthocyanins.
SMITH; 2019	The anti-acne gel-cream based on the oil of *Copaífera officinalis L*. has compatibility between the oil and the base formulation, absence of instabilities, adequate to physicochemical standards, proven stability throughout storage, presents microbial load within the standards specified by the legislation, is effective and safe to use.
MIRANDA; 2019	Jabuticaba has an excellent source of bioactive, high pectin yields and high levels of phenolic compounds, which enables the extraction of anthocyanins from the bark. Solvent extraction obtained a higher yield than enzymatic extraction. The combination of the two methods increased 60% in the yield of extracted anthocyanins.
CASTRO; 2014	Emulsions are vehicles with numerous advantages. These systems enable administration by various routes, can encapsulate compounds with different polarity, adapt to different modes of drug release, are low cost and are well accepted by consumers. Its main disadvantage is the ease of degradation.
FIDELIS; 2020	It was possible to realize that it is possible to use strategic raw materials to obtain specific characteristics in cosmetic emulsions. Specifications such as sensory aspect, consistency, type of hydration provided and type of use may vary according to the raw materials used and their respective concentrations
ROSÁRIO et.al. ; 2021	It can be verified that the emulsions were stable during the tests of centrifugation, pH, viscosity, microscopy, and organoleptic aspects during the 90 days in which they were under analysis in the laboratory, thus indicating that all the objectives were achieved in the production of moisturizing emulsion based on babassu oil.
MAGALHÃES; 2013	From the comparison of the results it was possible to observe that the use of hot and cold water in the heating and cooling steps, and the change in the order of addition of raw materials without phase inversion, do not cause significant changes that affect the conformity of the emulsion in question.

Source: Author Himself (2023).

Regarding the experimental tests, tables 3 and 4 were developed for the presentation of the experimental results of quality control of the cosmetic product.

Table 3. Results of laboratory tests

Sample	The concentration of extract added to the pharmaceutical form (%)	Aspect	Color	Odour	Centrifugation	Stability at different temperatures (ºC) 40 | 50 70*
1	1,5	Homogeneous and dense	White	Minty	Creaming	Stable
2	3,5		Slightly pink			
3	4,0		Rosy			

Source: Author Himself (2023).
Legend: * at a temperature of 70ºC only the formulation with 4.0% of extract presented flocculation.

Table 4. Results of laboratory tests associated with pH, density, and spreadability. Data are expressed as mean + standard deviation

Sample	ph	Density (g/cm^3)	Spreadability (mm^2)
1	5.85 ± 0.06	30.88 ± 8.31	1171.82 ± 704.17
2	5.73 ± 0.03	37.88 ± 2.23	1497.15 ± 101.09
3	5.72 ± 0.05	35.54 ± 4.60	1532.83 ± 242.23

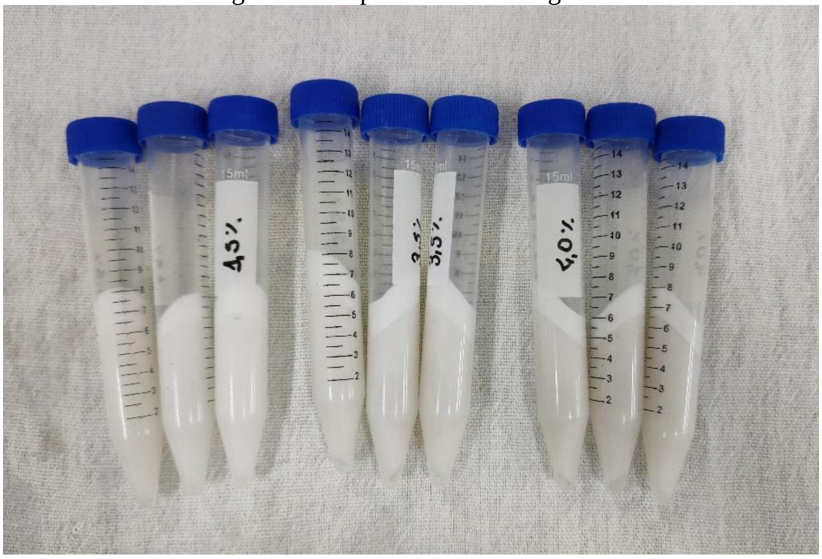
Source: Author Himself (2023).

According to Table 3, the sensory characteristics of the product remained unchanged in color, odor, and appearance during the tests performed over an evaluation period of 0 to 15 days (figure 2). During this period, the moisturizer retained a slightly pinkish color, a homogeneous and dense texture, and a characteristic aroma, and remained stable in macroscopic terms. All the samples presented creaming (figure 3) in the centrifugation test, which may be due to a disproportion in the number of inputs of the oily and aqueous phases, excessive or insufficient agitation, temperature shock during agitation, or excessive heating of the phases, and also inadequate pH.

Figure 2. Base cream incorporated with hydroalcoholic extract

Source: Author Himself (2023).

Figure 3. Samples after centrifugation



Source: Author Himself (2023).

All samples were subjected to heat stress conditions for preliminary stability evaluation, considering that this test aims to accelerate instability processes, such as the degradation of formulation components. It was observed that the samples of concentrations 1.5% and 3.5% remained stable after the test, with increased fluidity due to heating and characteristic odor and that concentrations of 4.0% presented flocculation at a temperature of 70°C. However, there was no separation of phases.

According to the results of Table 4, the pH of the moisturizer was found within the safe range (5.0 - 6.0), which makes it suitable for skin pH and reduces the risks of skin irritation, as well as making it a safer and more stable product for use. The pH of the skin varies depending on the region of the body and age, with the physiological pH situated between 4.6 and 6.0, which is considered slightly acidic and helps protect the skin surface against bacteria and fungi. The pH values of the moisturizer are within the range considered ideal for cosmetic formulations, so any variations in these values can be considered normal. The value density of the moisturizer was higher than expected, but there are no standardized density values for creams and lotions, as this varies according to the type and amount of inputs used in the formulation. It was expected that the incorporation of the hydroalcoholic extract of *Myrciaria Cauliflora* would reduce the density of the moisturizer, however, this did not occur. The density does not interfere with the quality of the product, as recommended by the quality specification, but there may not be a good acceptance in certain populations. The spreadability of the moisturizer increased as the weight was added, thus presenting a good spreadability, with the ability to spread and cover the site of action.

Skin aging caused by sun exposure is common to all individuals, although it can vary according to skin type and the intensity of exposure to UV radiation. Sunlight penetrates the skin and can cause molecular damage to chromophores, leading to alteration of their chemical structure, or even the creation of free radicals. The latter are unstable molecules with an odd number of electrons that, by oxidizing, can damage healthy cells such as DNA, proteins, and cell membranes, causing oxidative stress. Antioxidants, whether administered orally or topically, can help combat these harms of the sun by preventing or correcting lesions resulting from free radicals generated by UV radiation. Antioxidants are compounds that protect the body against oxidative reactions of macromolecules or cellular structures that can cause potentially harmful effects, and there is a wide range of substances that act at different levels (HENRIQUE and LOPES, 2017).

Based on the literature review, it was possible to identify that jabuticabeira is a plant with preservative, antioxidant, antimicrobial, and pigment properties, in addition to other secondary metabolites not yet studied, which suggests its potential use in the pharmaceutical and cosmetic industry.

Knowledge about the antioxidant properties of plants is a relatively recent topic, with a significant increase in scientific research in the last two decades. These researches range from the study of the effect of crude extracts to the analysis of isolated and/or modified fractions and components.

Several studies have been conducted to evaluate the antioxidant activity and phenolic compounds present in the jabuticaba fractions. The results indicate that the peel of the fruit presents a higher concentration of phenolic compounds, in addition to the highest antioxidant activity and ability to sequester the DPPH radical (1,1-diphenyl-2-picrylhydrazil). This high antioxidant activity can be attributed to the high amount of anthocyanins present in the bark of jabuticaba (MEIRE et al., 2016).

The bark of jabuticabas has a higher anthocyanin content when compared to the pulps and seeds. Comparative studies of the content of anthocyanins present in the peels of different fruits and vegetables showed that the bark of jabuticaba has the highest content of these compounds. Two anthocyanins were identified in the bark of jabuticaba, cyanidin-3-glycoside, and delphinidin-3-glycoside, which have a structure with two or three hydroxyls in the ring and have great antioxidant power (BARBOSA, 2014; MEIRA. et al, 2017).

The stability profile of a product is important to evaluate its performance, safety, efficacy, and consumer acceptance. It provides information on the behavior of the product in the face of environmental conditions, from manufacture to the end of shelf life. Organoleptic assays are useful to immediately assess the state of the product and identify possible changes, such as phase separation, precipitation, and turbidity. These analyses allow the primary recognition of the product. (Anvisa, 2020).

5 CONCLUSION

The literature review shows the growing interest of the population in products with an ecological footprint, and more and more industries have sought to meet this demand. However, there is not much focus on studies and product development from native species of Brazil. The fruits of the *Myrciaria* family have several functions such as antimicrobials, anti-inflammatories, and even antioxidants. Many of the plants in this family are used by traditional medicine, but there are still few studies on the antioxidant properties of these fruits.

The cost-benefit of using jabuticaba peels for the production of antioxidant cosmetics can be positive, considering that a jabuticabeira can produce tons of fruit per year and tons of peels are wasted by food industries every year.

The moisturizer obtained from the hydroalcoholic extract of the peels of *Myrciaria cauliflora* has a potential cosmetological profile, since it has compatibility with the basic formulation, and absence of instabilities in almost all the tests applied in this work, being adequate to the physicochemical standards required by legislation. In addition, in future work, it is necessary to focus on developing studies of the microbial action of the product, and greater rigidity in the process of development and formulation of the base cream.

It is expected that this work can be an incentive for the development of studies about native fruits of Brazil for use in the cosmetic industry, and also encourage the conscious use of these raw materials, through sustainable measures for the environment, such as the reuse of industrial waste previously mentioned.

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